

Two new species of *Begonia* (Begoniaceae) from Bali and Lombok

Wisnu H. Ardi¹, I.M. Ardhaka², M. Hughes³,
N.K.E. Undaharta², D. Girmansyah⁴ and S. Hidayat¹

¹Bogor Botanic Garden, Jl. Ir. H. Juanda No. 13, Bogor, Indonesia
wisn001@lipi.go.id

²Bali Botanic Garden, Candikuning, Baturiti, Tabanan 82191, Indonesia

³Royal Botanic Garden Edinburgh, 20A Inverleith Row,
Edinburgh EH3 5LR, Scotland, U.K.

⁴Herbarium Bogoriense, Indonesian Institute of Sciences,
Cibinong 16911, Indonesia

ABSTRACT. Two new species of *Begonia*, *B. lugrae* Ardhaka & Undaharta and *B. sendangensis* Ardi are described from Bali and Lombok, respectively. The species belong to *Begonia* section *Reichenheimia*. A checklist and identification key to the Bali and Lombok species of *Begonia* are provided.

Keywords. Bali, *Begonia*, Lombok, new species

Introduction

Begonia is one of the largest angiosperm genera, comprising approximately 1500 species which are distributed in tropical and subtropical Africa, America and Asia and Pacific Islands (Hughes 2008). The Southeast Asian species remain the most poorly known, with many novelties still being discovered recently (Girmansyah 2012; Sang et al. 2013; Phutthai et al. 2012). The first account dedicated to the *Begonia* of Bali and Lombok was published by Girmansyah (2009), which reported five new species and one new record, bringing the total number of species known from the two neighbouring islands to eight species.

During field surveys of *Begonia* in Gianyar, Bali in 2010 organised by the Bali Botanic Garden, and in Lombok in 2012 led by the Bogor Botanic Garden, two new species of *Begonia* were collected, here newly named as *Begonia lugrae* Ardhaka & Undaharta and *Begonia sendangensis* Ardi. All available specimens from ANDA, BO, E, K, L and SING have been consulted, and hence it must be assumed, at least until more intensive collecting in Bali may reveal otherwise, that the species have a very restricted range (Fig. 1). All the specimens cited are included in the Southeast Asian *Begonia* Database (Hughes & Pullan 2007), which is accessible online (<http://elmer.rbge.org.uk/begonia/>).

Four of the species are classified in *Begonia* sect. *Sphenanthera* (Hassk.) Warb., another four including the two new species are in *Begonia* sect. *Reichenheimia*

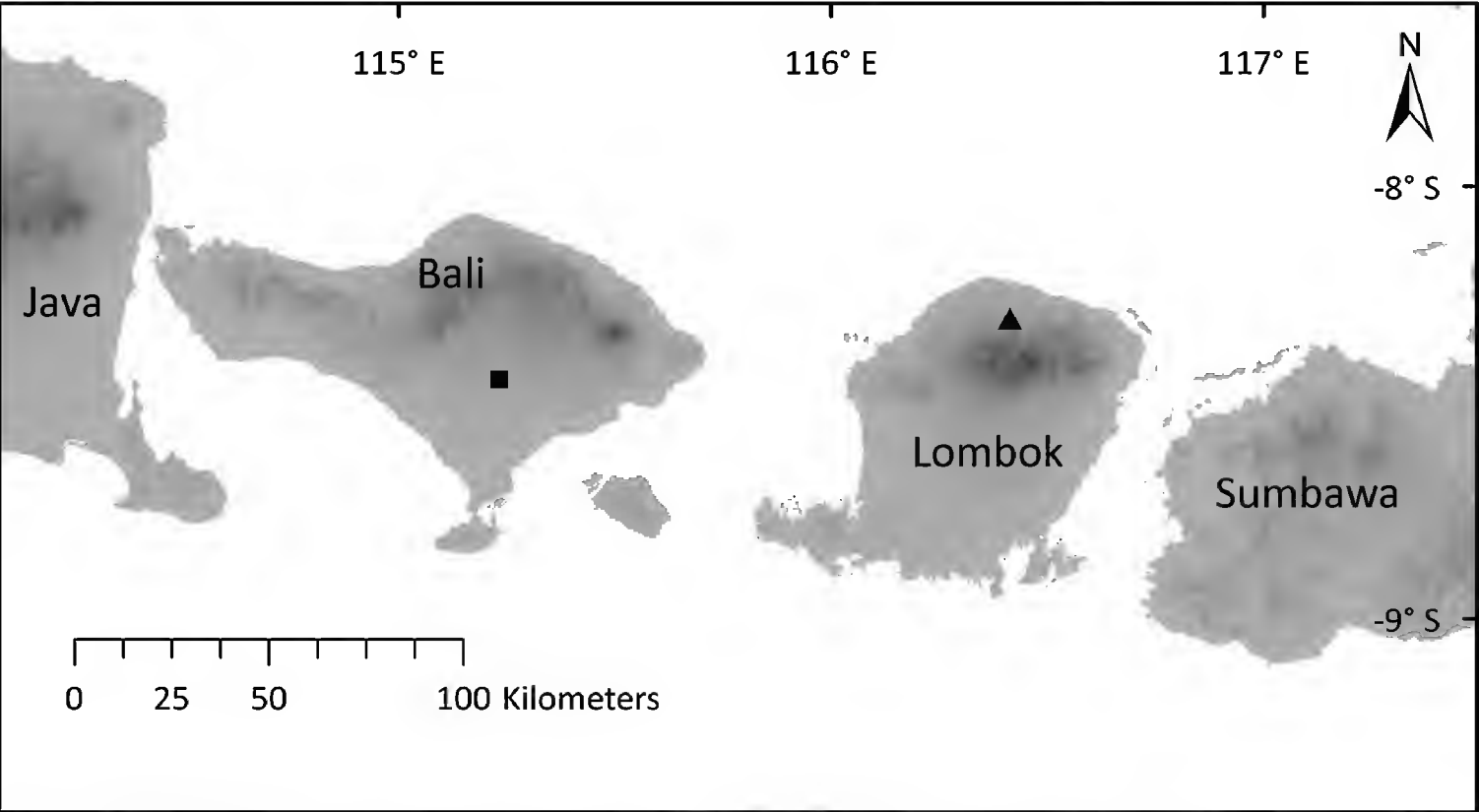


Fig. 1. Distribution of *Begonia lugrae* (squares) and *B. sendangensis* (triangles).

(Klotzsch) A.DC., and a single species each are in *Begonia* sect. *Parvibegonia* A.DC. and *Begonia* sect. *Petermannia* (Klotzsch) A.DC. (Table 1). The two new species exhibit typical characters of *Begonia* sect. *Reichenheimia*: rhizomatous or tuberous stems, protandrous inflorescences, and three locular ovaries with entire placentae (Doorenbos et al. 1998).

Table 1. The indigenous *Begonia* species of Bali and Lombok.

Section	Species
<i>Parvibegonia</i>	<i>Begonia tenuifolia</i> Dryand.
<i>Petermannia</i>	<i>Begonia lombokensis</i> Girm.
<i>Reichenheimia</i>	<i>Begonia coriaceae</i> Hassk.
	<i>Begonia lugrae</i> Ardhaka & Undaharta
	<i>Begonia sendangensis</i> Ardi
	<i>Begonia pseudomuricata</i> Girm.
<i>Sphenanthera</i>	<i>Begonia baliensis</i> Girm.
	<i>Begonia lempuyangensis</i> Girm.
	<i>Begonia longifolia</i> Blume
	<i>Begonia multibracteata</i> Girm.

Key to *Begonia* from Bali and Lombok

- 1a. Plant with erect stems..... 2
- b. Plant repent or stemless..... 6

- 2a. Female inflorescences basal to male; male and female flowers with 2 tepals; fruit a dry capsule with well developed equal wings *B. lombokensis*
- b. Female and male flowers occurring together in cymose inflorescences; male flowers with 4 tepals, female 5 or 6 tepals; fruit fleshy with reduced wings or one wing larger..... 3

- 3a. Fruit wings reduced to three equally short wings or ridges; lamina oblong to lanceolate; margin shallowly toothed to sub-entire; female flowers with 6 tepals..... *B. longifolia*
- b. Fruit with one larger wing; lamina ovate to broadly ovate; margin scalloped; female flowers with 5 tepals..... 4

- 4a. Inflorescence hairy; bracts persistent *B. multibracteata*
- b. Inflorescence glabrous; bracts caducous 5

- 5a. Lamina ovate; stem hairy *B. baliensis*
- b. Lamina broadly ovate; stem glabrous *B. lempuyangensis*

- 6a. Plants tuberous 7
- b. Plants rhizomatous 8

- 7a. Stem erect and weak; internodes elongated; inflorescence terminal, racemose; female flowers with 5 tepals; ovary with 2 locules; placentation bilamellate.....
..... *B. tenuifolia*
- b. Stemless; internodes compressed; inflorescences lateral, cymose; female flowers with 3 tepals; ovary with 3 locules; placentation entire *B. sendangensis*

- 8a. Leaves peltate..... *B. coriacea*
- b. Leaves basifixed 9

- 9a. Lamina 14–16.5 × 12–15 cm; margin crenate or minutely toothed to entire, peduncle shorter than petioles *B. lugrae*
- b. Lamina 5.5–10 × 5–9 cm; margin undulate, peduncle longer than petioles
..... *B. pseudomuricata*

The new species

Begonia lugrae* Ardhaka & Undaharta sp. nov. § *Reichenheimia

Similar to *Begonia pseudomuricata*, differing from that species by the broader, asymmetric stipules with a fleshy extension, subentire (not undulate) leaf margin, larger leaf lamina (14–16.5 × 12–15 cm) compared to in that species (5.5–10 × 5–9 cm), and the peduncle being shorter than the petioles.

TYPE: *Ni Kadek Erosi Undaharta RS 03*, cultivated at Bali Botanic Garden from vegetative material collected in the wild from Melinggih village, Yeh Ayung River, Gianyar, Bali, Indonesia, 08°26'50.3"S 115°13'55.9"E, 26 Jul 2013 (holo BO; iso E, KRB, Bali Botanic Garden Herbarium). Fig. 2.

Perennial, creeping, rhizomatous monoecious herb, 15–17 cm tall. **Stems** internodes short, 5–8 mm long, glabrous, reddish with white spots at the nodes; stipules semi-circular, 6–10 × 12–15 mm, asymmetric, pale green, with an abaxially prominent hirsute reddish midrib up to c. 15 mm long, persistent. **Leaves** alternate; petioles 24–33.5 cm long, glabrous, reddish at base and green towards to apex; lamina basifixed, 14–16.5 × 12–15 cm, asymmetric, ovate, base cordate, lobes overlapping, apex shortly attenuate, margin sub-entire, with minute recurved teeth at the end of the veins, adaxial surface glabrous, green, raised slightly between the veins; venation palmate, veins paler green above, primary veins 7–8. **Inflorescence** cymose, with 5–10 flowers, axillary, protandrous, bisexual; peduncles 19.5–27.5 cm long, pale green, glabrous; bracts sub-orbicular, red, c. 2 × 3 mm, margin slightly fimbriate, deciduous. **Male flowers:** pedicels 5–15 mm, glabrous; tepals 4, white, outer tepals 2, c. 13 × 16 mm, sub-orbicular, base slightly cordate, margin entire, apex rounded or slightly undulate, glabrous; inner tepals 2, c. 13 × 8 mm, narrowly obovate, glabrous; androecium yellow, symmetric, globose; stamens c. 90, filaments c. 1 mm long, fused at the base, anthers c. 3 mm long, obovate, dehiscing through lateral slits c. 1/2 as long as the anther, connective not projecting. **Female flowers:** pedicels 7–15 mm, glabrous, bracteoles absent; tepals 3, white, unequal, two outer tepals orbicular to sub-orbicular, 12 × 14 mm, margin entire, apex rounded or undulate, one inner tepal, narrowly obovate, 6 × 12 mm; ovary sub-globose, 8–9 × 6–7 mm (excluding wings), locules 3, placentation axile, placentae entire, wings 3, subequal, triangular, rounded at the base and cuneate at the apex, the widest point at the middle of the ovary, glabrous; stigmas 3, shallowly U-shaped, stigmatic surface once spirally twisted. **Fruits** not seen.

Distribution. Endemic to Bali, Gianyar District, Melinggih village, Yeh Ayung River embankment.

Habitat. This species grows on the shaded steep rocky cliffs in the Yeh Ayung River embankment at 630 m elevation.

IUCN Conservation category. *Begonia lugrae* is currently only known from a single population, which is not in a formally protected area. Although locally abundant,

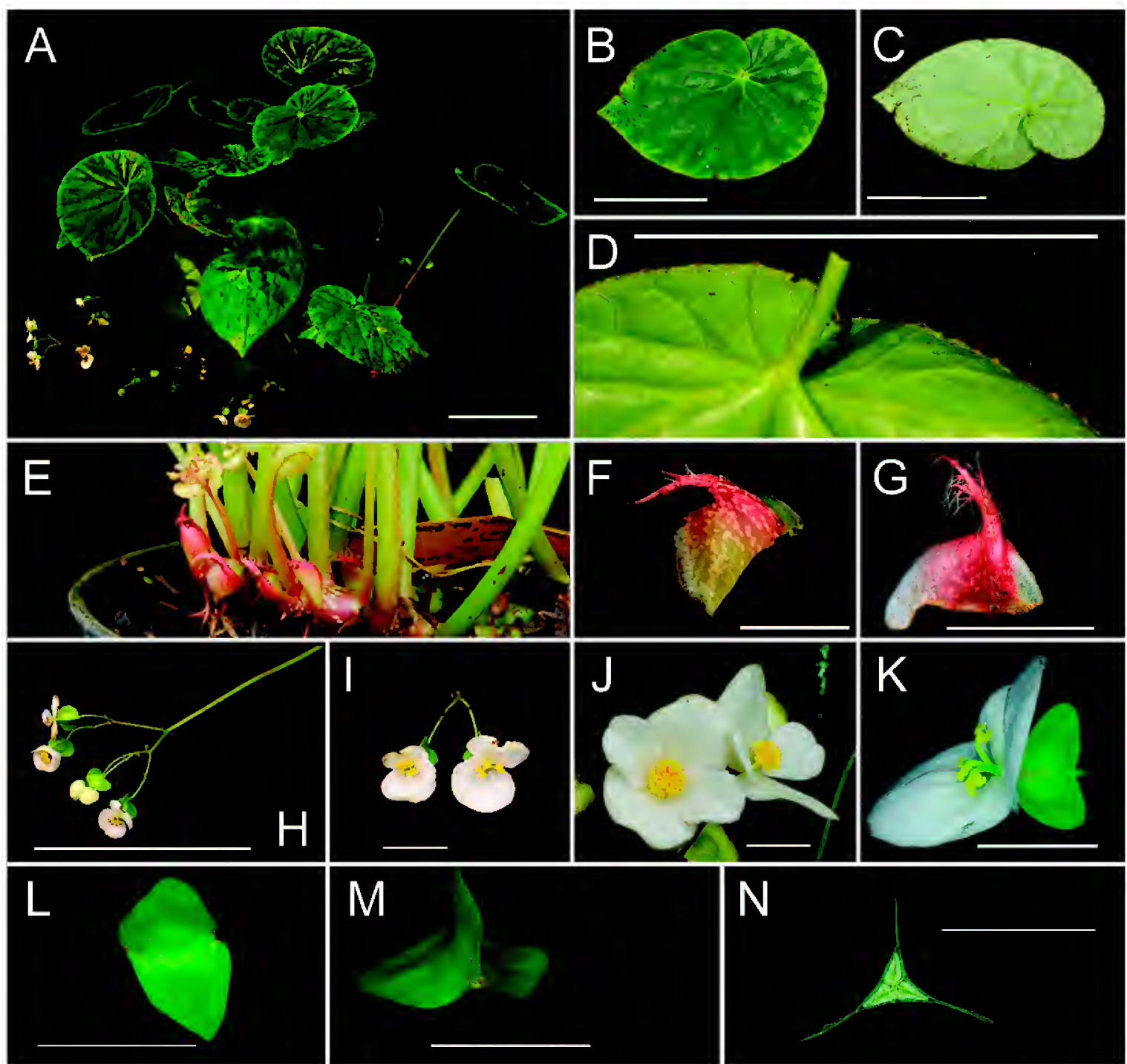


Fig. 2. *Begonia lugrae* from cultivated material in the Bali Botanic Garden. **A.** Habit. **B–D.** Lamina. **E.** Rhizomes. **F–G.** Stipule. **H–I.** Inflorescence. **J.** Male flowers. **K.** Female flower. **L.** Fruit, side view. **M.** Fruit, apical view. **N.** Ovary transverse section. Scale bars: J (1 cm); F, G, I, K–N (2 cm); A–D, H (10 cm). (Photos: A–I & K–N, Gede Wawan; J, Wisnu H. Ardi)

with at least 75 plants in the population, this makes the species vulnerable to future disturbance, and a provisional IUCN category of VUD2 is appropriate.

Notes. The species is named in honour of the Director of Bali Botanic Garden, I Nyoman Lugrayasa who generously supported many *Begonia* expeditions. This species is morphologically similar to *Begonia pseudomuricata* Girmansyah. However *B. lugrae* is distinct in its bigger leaves $14\text{--}16.5 \times 12\text{--}15$ cm (versus $5.5\text{--}10 \times 5\text{--}9$ cm) with sub-entire margin, whereas in *B. pseudomuricata* the margin is undulate. The length of the inflorescence peduncle and the shape of the stipules are further differences: the peduncles of *B. lugrae* (19.5–27.5 cm long) are always shorter than the petioles (24–33.5 cm long) while in *B. pseudomuricata* the peduncles (10–25 cm

long) are always longer than the petioles (5–20 cm long); in *B. lugrae* the stipules are very distinctive, being asymmetric and having a fleshy extension at the tip.

Begonia sendangensis* Ardi sp.nov. § *Reichenheimia

B. sendangensis differs from *B. pseudomuricata* and *B. lugrae* in its considerably smaller stature and in possessing a tuber; the latter character also distinguishes it from all other Indonesian species of *Begonia* sect. *Reichenheimia*.

TYPE: *WI* 82, cultivated at Bogor Botanic Garden from vegetative material collected in the wild from Senaru Village, Sandang Forest Reserve, Bayan Sub district, Lombok Utara District, Nusa Tenggara Barat, Indonesia, 08°18'23.3"S 116°24'47.9"E, 20 Apr 2013 (holo BO). Fig. 3.

Perennial, tuberous, monoecious herb, up to 10 cm tall. **Stems** very reduced, internodes c. 1 mm long; stipules, ovate, c. 3×1.5 mm, midrib prominent, sparsely hirsute, tip projecting c. 1.5 mm, persistent. **Leaves** alternate; petioles, 2.7–3.5 cm long, green, with scattered multicellular glandular hairs; lamina basifixed, $3.3\text{--}9 \times 2.7\text{--}6$ cm, asymmetric, ovate, base cordate, lobes rarely overlapping, apex attenuate, margin shallowly lobed, sparsely villose, with minute recurved teeth at the end of the veins, adaxial surface glabrous, green, raised slightly between the veins; venation palmate, veins pale green, primary veins 5–6. **Inflorescence** cymose, few-flowered, axillary, protandrous, bisexual; peduncles 2.5–3.9 cm long, pale green, glabrous; *bracts* minute, sub-orbicular, margin slightly fimbriate, deciduous. **Male flowers:** pedicels 14–20 mm long, tepals 4, pink, outer tepals 2, $10\text{--}12 \times 12\text{--}15$ mm, sub-orbicular, abaxially sparsely hairy, inner tepals 2, $11\text{--}13 \times 6\text{--}9$ mm, obovate to elliptic; androecium yellow, symmetric, globose, stamens c. 35, filaments fused at base into a short column c. 1.5 mm long; anther c. 1 mm long, narrowly obovate, dehiscing through lateral slits longer than half the length of the anther, apex retuse. **Female flowers:** 1 or 2, pedicels 15–17 mm long, bracteoles present, subulate, c. 2 mm long, persistent; tepals 3, pink, unequal, two outer tepals broadly ovate, c. $9\text{--}10.5 \times 14$ mm; sparsely hairy on abaxial surface, one inner tepal elliptic, 9.5×5.5 mm, glabrous; ovary $5\text{--}7 \times 5\text{--}5.5$ mm (excluding wings), ellipsoid, glabrous, green, locules 3, placentation axile, placentae entire, wings 3, equal, pinkish, rounded at base, rounded to truncate at apex, widest point 6–8 mm long just below the apex; stigmas 3, U-shaped, stigmatic surface once spirally twisted. **Fruit** with pedicel c. 15–18 mm long, capsule ellipsoid, c. 8×6 mm, (excluding wings), dehiscent, splitting along the wing attachments, wing shape as for the ovary, wings widest subapically, c. 8.5 mm wide.

Distribution. Endemic to Lombok, in the Sendang Gile Forest Reserve.

Habitat. This species grows on limestone cliffs in semi-shade.

IUCN Conservation category. *Begonia sendangensis* is probably a narrow endemic, restricted to the Sendang Gile Forest Reserve, where it does not form large colonies

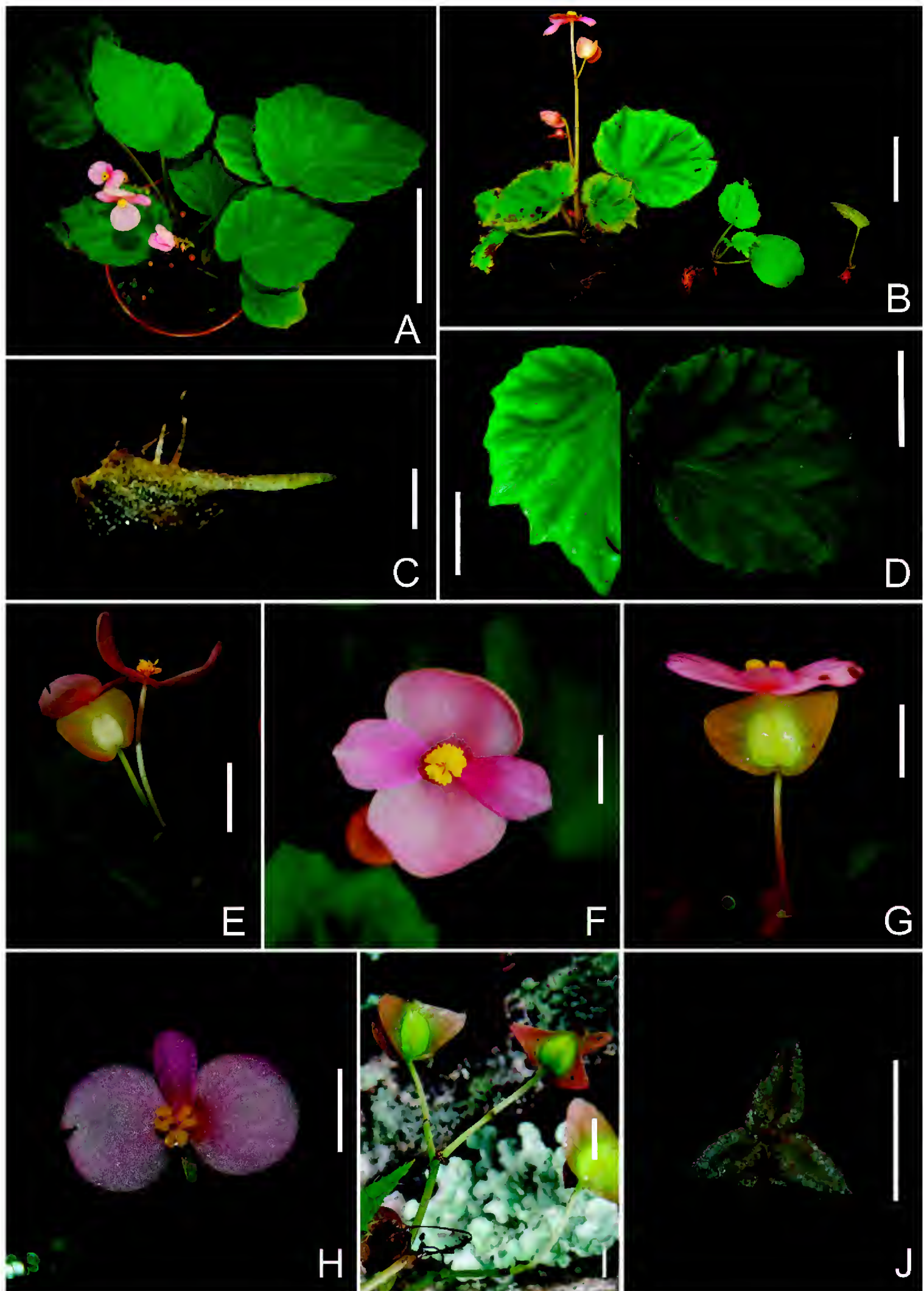


Fig. 3. *Begonia sendangensis*. **A–B.** Habit. **C.** Stipule. **D.** Lamina. **E.** Inflorescence. **F.** Male flower. **G.** Female flower showing ovary, side view. **H.** Female flower, top view. **I.** Fruit. **J.** Ovary transverse section. Scale bars: C (1 mm); J (5 mm); E–I (1cm); A, B, D (5 cm). (Photos: A–H & J, Wisnu H. Ardi; I, Syamsul Hidayat)

but appears to occur as scattered individuals on steep cliffs at the edge of the reserve. The narrow distribution and dependence on limestone means that a provisional IUCN category of VUD2 is appropriate, despite the area being protected.

Notes. The epithet '*sendangensis*' refers to Sendang Gile Forest Reserve from where the type material was collected. *Begonia sendangensis* is unique in *Begonia* section *Reichenheimia* in Indonesia on account of its tuberous habit. The presence of tubers in this species are probably an adaptation to its limestone habitat and the seasonally dry climate in the Lombok region. This is convergent with a number of other species which are found in the seasonally dry limestone habitats of continental Asia (southern China, Indochina, and the Thai Peninsula). Some of these are also currently in *Begonia* sect. *Reichenheimia* (e.g., *Begonia harmandii* Gagnep, *B. hymenophylla* Gagnep, *B. intermixta* Irmsch., *B. parvula* Irmsch.), but are likely to belong to the 'Diploclinium grade' (Rajbhandary et al. 2011) which has its centre of diversity in this area. The region also harbours most of the species in *Begonia* sect. *Parvibegonia* (e.g., *Begonia integrifolia* Dalzel., *B. bella* Putthai, *B. sinuata* Meisn.) which are characterised by the presence of tubers. Tuberous species are not well represented from the ever-wet areas of the Sunda shelf.

ACKNOWLEDGEMENTS. The authors would like to express gratitude to Ir. I Nyoman Lugrayasa (Bali Botanic Garden Director) for supporting *Begonia* expeditions on Bali; and to the curators of ANDA, BO, E, K, L and SING for allowing us access to herbarium material.

References

- Doorenbos, J., Sosef, M.S.M. & de Wilde, J.J.F.E. (1998) The sections of *Begonia* including descriptions, keys and species lists (Studies in Begoniaceae VI). *Agric. Univ. Wageningen Pap.* 98(2): 1–266.
- Girmansyah, D. (2009) A taxonomic study of Bali and Lombok *Begonia* (Begoniaceae). *Reinwardtia* 12(5): 419–434.
- Girmansyah, D. (2012) *Begonia ranaiensis* (Begoniaceae), a new species from Mt Ranai, Natuna Island, Indonesia. *Kew Bulletin* 68:1–4.
- Hughes, M. (2008) *An Annotated Checklist of Southeast Asian Begonia*. U.K.: Royal Botanic Garden, Edinburgh.
- Hughes, M. & Pullan, M. (2007) Southeast Asian *Begonia* Database. <http://elmer.rbge.org.uk/Begonia/>
- Sang, J., Kiew, R. & Geri, C. (2013) Revision of *Begonia* (Begoniaceae) from the Melinau Limestone in Gunung Mulu National Park and Gunung Buda National Park, Sarawak, Borneo, including thirteen new species. *Phytotaxa* 99(1): 1–34.
- Phutthai, T., Hughes, M. & Sridith, K. (2012) A new species of *Begonia* (Begoniaceae) from Peninsular Thailand. *Edinburgh J. Bot.* 69(2): 287–292.
- Rajbhandary, S., Hughes, M., Phutthai, T., Thomas, D.C. & Shrestha, K.K. (2011) Asian *Begonia*: out of Africa via the Himalayas? *Gard. Bull. Singapore* 63(1&2): 277–286.